



**STAFF REPORT: NEW EMISSION STANDARDS,
FLEET REQUIREMENTS, AND TEST PROCEDURES
FOR FORKLIFTS AND OTHER INDUSTRIAL EQUIPMENT**



Date of Release: March 3, 2006
Scheduled for Consideration: April 20, 2006

In-Use Off-Road Large Spark-Ignition (LSI) Engine Fleet Requirements Tutorial

August 1, 2012

California Environmental Protection Agency



Air Resources Board

Overview

- What is LSI
- The LSI Regulation
- Fleet Average
 - Applicability
 - Forklift Definition
 - Requirements
 - Calculations
 - Exemptions & Exclusions
 - Agricultural & Forest Provisions
 - Equipment Dealer Provisions
 - Ground Support Equipment Provisions
- Advisories & Factsheets
- Compliance Extensions
- Recordkeeping & Enforcement
- Contact Information



What is LSI?

- Greater than 25 horsepower
- Greater than 1 liter displacement
- Based on automotive technology
- Gasoline, propane, and CNG fuel
- Not diesel
- Not portable equipment

California's LSI Regulations

- First adopted in 1998
 - New Engine Standards and Test Procedures
 - Phase in of 3.0 g/bhp-hr by 2004 model year
 - Represents 75 percent emission reduction
- Amended in May 2006
 - New Engine Standards and Test Procedures
 - 2.0 g/bhp-hr in 2007; 0.6 g/bhp-hr in 2010
 - Represents 95 percent emission reduction
 - Retrofit Kit Verification Procedures
 - Fleet Requirements

California's LSI Regulations (cont.)

- Amended in December 2010
 - Fleet Requirements only
 - Added agricultural and forest operations; boneyard, in-field, operations, retired, and service equipment definitions
 - Modified airport ground support equipment and fleet average emission level definitions
 - Reinstated limited hours of use provisions
 - Established longer Compliance Extension period
- Became law in December 2011

Fleet Average Applicability & Intent

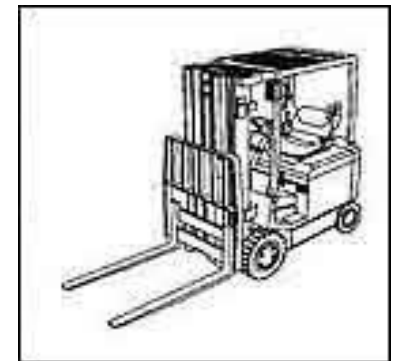
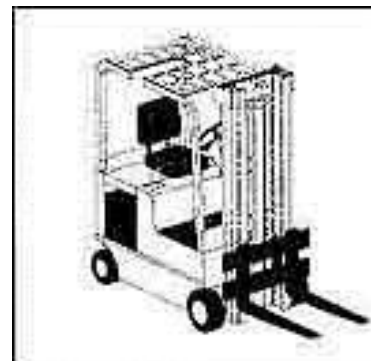
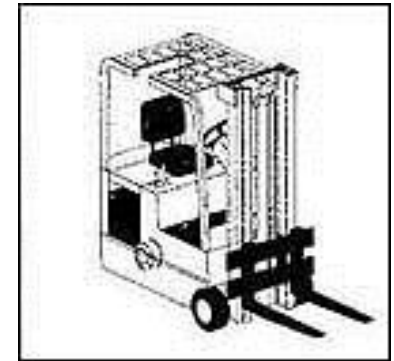
- Applicability
 - 4 or more forklifts, tow tractors, sweeper/scrubbers, or pieces of airport ground support equipment (GSE)
- Intent
 - Decrease fleet average emissions through turn over and retrofit or replacement of uncontrolled engines

Forklift Definition

- For the purposes of the LSI Fleet Regulation
- “Forklift” means:
 - An electric Class 1 or 2 rider truck, or
 - An LSI engine-powered Class 4 or 5 rider truck
 - As defined by the Industrial Truck Association (<http://www.indtrk.org>)
- “Forklift” does not mean:
 - An electric Class 3 truck (e.g., pallet jacks & walkies)
 - Man lifts, scissors lifts, and bucket/boom lifts

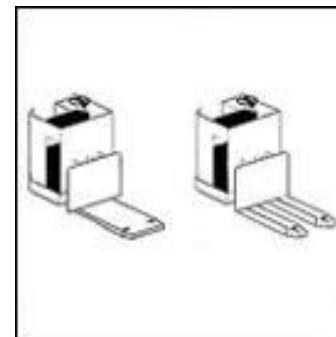
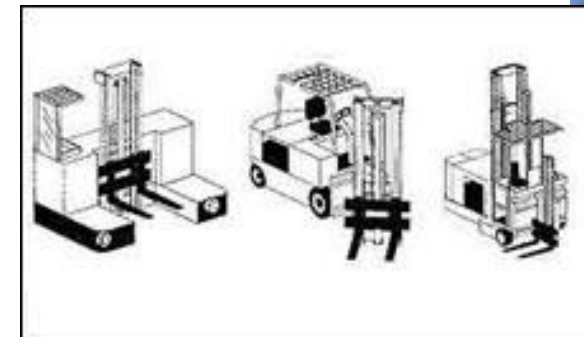
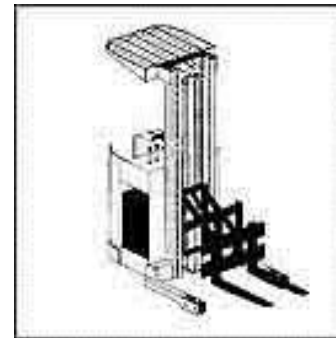
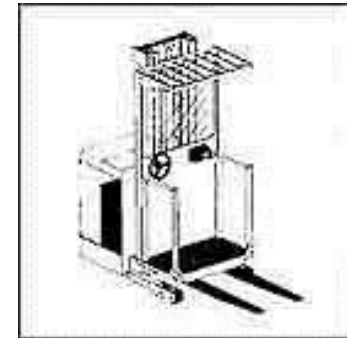
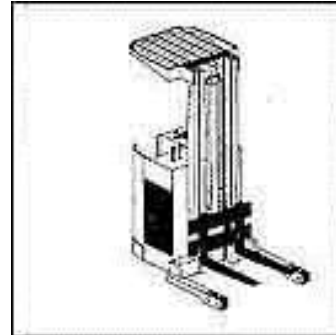
Class 1 Forklifts (4 subclassifications)

- Lift Code 1
 - Counterbalanced Rider
 - Stand Up
- Lift Code 4
 - Three wheel
 - Sit Down
- Lift Code 5
 - Counterbalanced Rider
 - Cushion tires
 - Sit Down
- Lift Code 6
 - Counterbalanced Rider
 - Pneumatic/Cushion tires
 - Sit Down



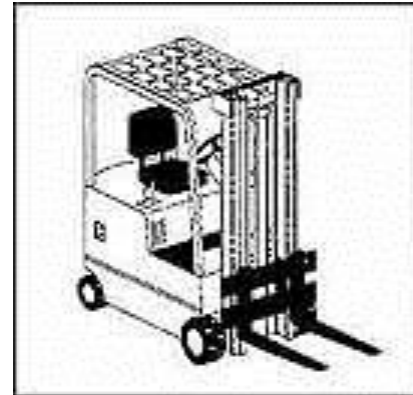
Class 2 Forklifts (5 subclassifications)

- Lift Code 1
 - High Lift Straddle
- Lift Code 2
 - Order Picker
- Lift Code 3
 - Reach Type Outrigger
- Lift Code 4
 - Side Loaders, Turret Trucks, Swing Mast and Convertible Turret/Stock Pickers
- Lift Code 6
 - Low Lift Pallet and Platform (Rider)



Class 4 and 5 Forklifts

- Class 4; Lift Code 3
 - Counterbalanced Rider
 - Cushion Tire



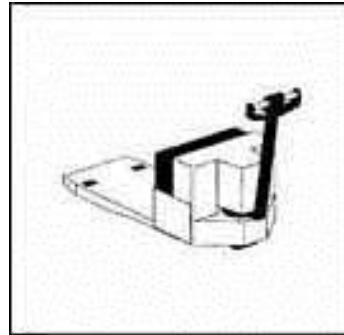
- Class 5; Lift Code 4
 - Counterbalanced Rider
 - Pneumatic Tire



Class 3 Forklifts (Lift Codes 1 – 4)

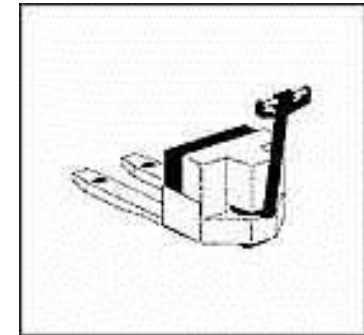
- Lift Code 1

- Low Lift Platform



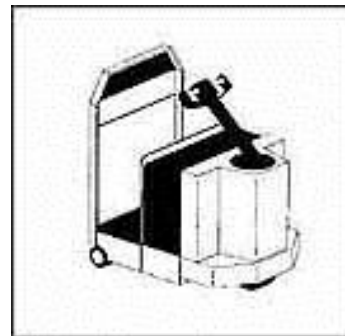
- Lift Code 2

- Low Lift Walkie Pallet



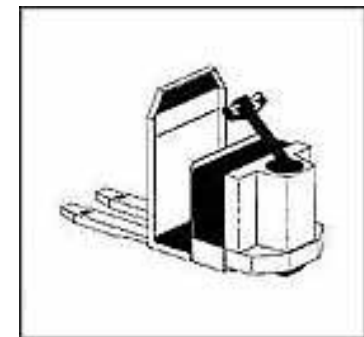
- Lift Code 3

- Tractors
- Draw Bar Pull < 999 pounds



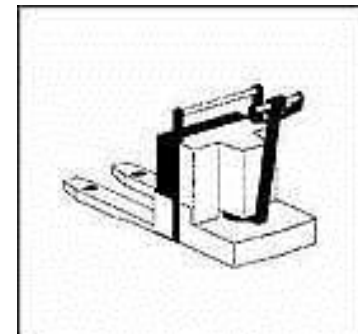
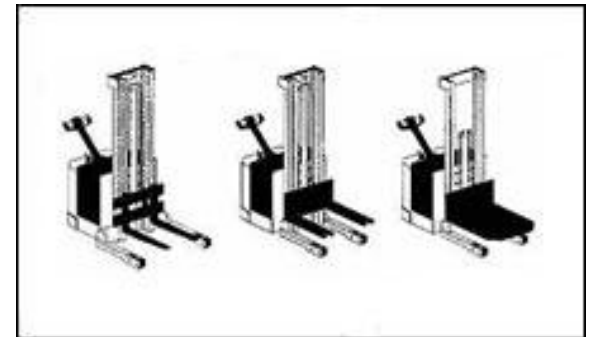
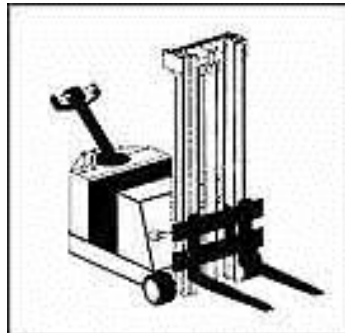
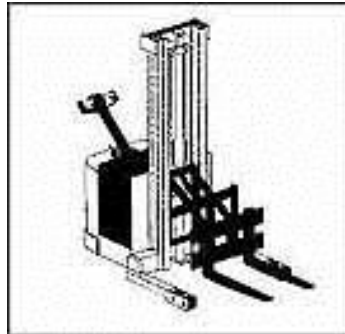
- Lift Code 4

- Low Lift Walkie/Center Control



Class 3 Forklifts (Lift Codes 5 – 8)

- Lift Code 5
 - Reach Type Outrigger
- Lift Code 6
 - High Lift Straddle
- Lift Code 7
 - High Lift Counterbalanced
- Lift Code 8
 - Low Lift Walkie/Rider Pallet



Ground Support Equipment Definition

- LSI engine or electric-powered (can be < 19 kW)
- 23 subcategories (as identified in 11/27/02 MOU)

Air Conditioner	Cart	Lavatory Cart
Air Start	Catering Truck	Lavatory Truck
Aircraft Tractor	De-icer	Lift
Baggage Tractor	Fork Lift	Other
Belt Loader	Fuel Truck	Passenger Stand
Bobtail	Generator	Service Truck
Cargo Loader	Ground Power Unit	Sweeper
Cargo Tractor	Hydrant Truck	Water Truck

- Includes “On-Road Equivalent GSE,” those pieces of GSE designed for, but not licensed for on-road use

Fleet Average Emission Level

- Standards

**Fleet Average Emission Level Standard
in Grams HC+NOx per kilowatt-hour (brake horsepower-hour)**

LSI Fleet Type	Number of units	By 1/1/2009	By 1/1/2011	By 1/1/2013
Forklift – large fleet	26 +	3.2 (2.4)	2.3 (1.7)	1.5 (1.1)
Forklift – mid-size fleet	4-25	3.5 (2.6)	2.7 (2.0)	1.9 (1.4)
Non-forklift – GSE, tow tractor, sweeper	N/A	4.0 (3.0)	3.6 (2.7)	3.4 (2.5)

- GSE forklifts must comply with the forklift standards

Fleet Average Emission Level (Cont.)

- On-Road Equivalent GSE Standards
 - Vehicles designed for, but not licensed for, on-road operation
 - Examples: Catering, Fuel, Lavatory, and Water Trucks
- For the purposes of calculating the Fleet Average Emission Level, GSE equipment operators must use the following On-Road Equivalent HC+NO_x defaults:
 - January 1, 2009 FAEL Standard – 1.5 g/kW-hr (1.1 g/bhp-hr)
 - January 1, 2011 FAEL Standard – 1.1 g/kW-hr (0.8 g/bhp-hr)
 - January 1, 2013 FAEL Standard – 0.9 g/kW-hr (0.7 g/bhp-hr)

Calculating the Fleet Average

- Not based on hours of use, horsepower, or emission factors
- Is a straight average of HC+NOx certification/verification standards and a default value for uncontrolled engines
 - Pre-2000 and uncontrolled 2001-2004 MY engines:
 - **16.0 g/kW-hr or 12.0 g/bhp-hr**
 - Controlled 2001-2004 and all 2005-2006 MY engines:
 - **4.0 g/kW-hr or 3.0 g/bhp-hr**
 - 2007 MY and newer engines:
 - **0.8 – 2.7 g/kW-hr (0.6 – 2.0 g/bhp-hr)**
 - Engine labels
 - OEM-certified engines and verified retrofit kits
 - Typically on valve cover or other conspicuous location

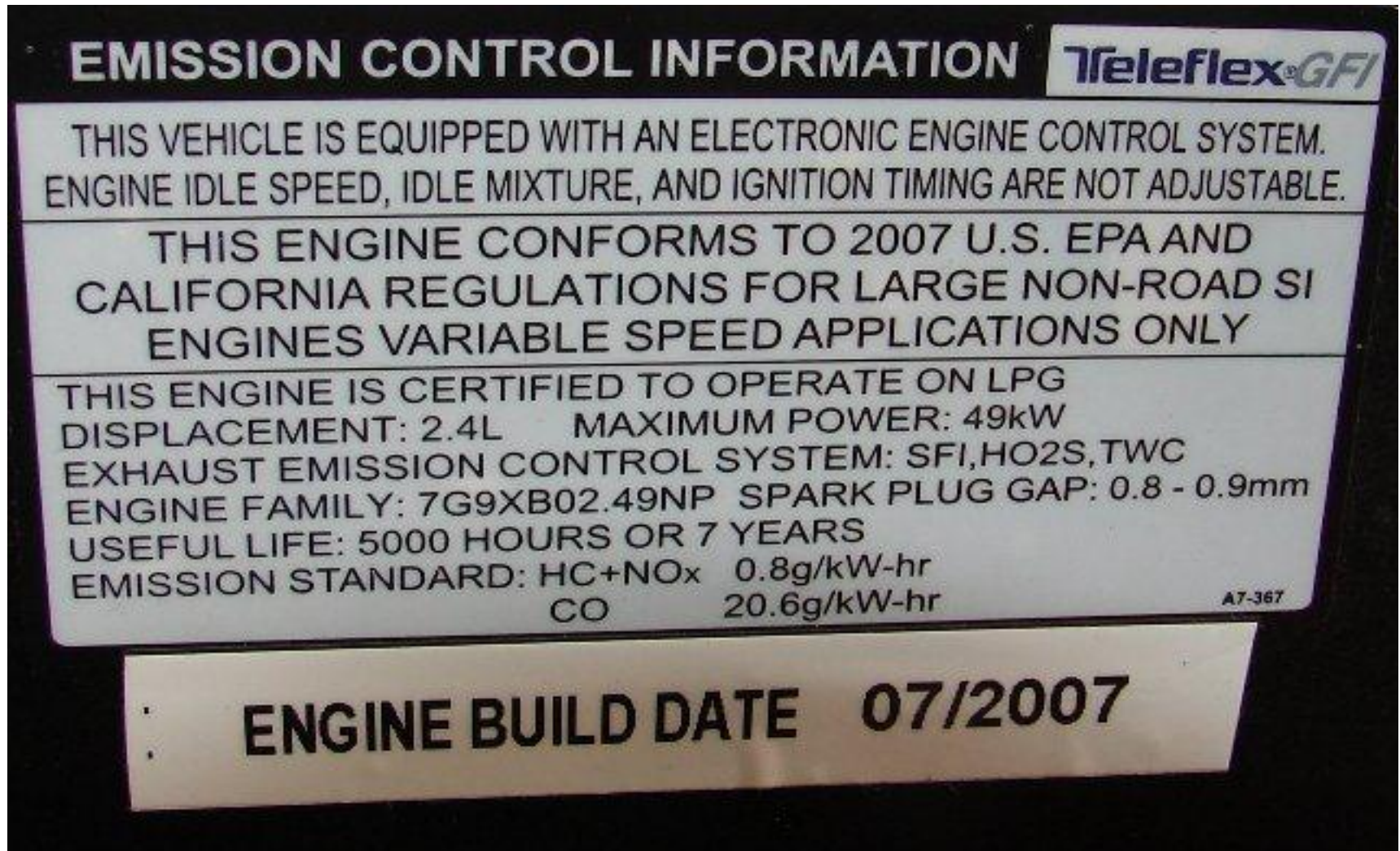
2001 – 2004 Uncontrolled Label



2001 – 2006 Controlled Label



2007 and Newer Label



Fleet Average Calculators

- No ARB calculator
- Several third party calculators including:
 - Nett Technologies:
<http://www.nett.ca/tools/lsi/index.html>
 - Pape Material Handling:
<http://www.papemh.com/carb.aspx>
 - Raymond Handling Solutions:
http://www.raymondhandlingsolutions.com/Emissions_calculator.html
 - Toyota Material Handling:
<http://tmhnc.com/training/downloads>

Fleet Average Exemptions/Exclusions

- Exemptions

- Small Fleets
 - 3 or fewer forklifts, and/or
 - 3 or fewer pieces of non-forklift LSI engine equipment
- Rental or lease equipment operated 30 or fewer aggregated calendar days per year
- In-field forklifts

- Exclusions

- Limited hours of use (less than 200 based on prior calendar year)
- Rental or lease of less than one year provided:
 - No more than 20 percent of fleet (otherwise, exclusion applies only to first 20 percent), and
 - Meets a 2.7 g/kW-hr (2.0 g/bhp-hr) standard
- Boneyard and Retired equipment

Agricultural Provisions

- Agricultural Crop Preparation Services (ACPS)
 - Packinghouses, nut hullers and processors cotton gins, dehydrators, feed and grain mills
 - Milling, peeling, producing particle board and MDF and woody landscape materials
 - Other “postharvest crop activities:”
 - NAICS definitions for Industries 115114, 321113, and 321219:
 - <http://www.census.gov/epcd/naics02/def/ND115114.HTM>
 - <http://www.census.gov/epcd/naics02/def/ND321113.HTM>
 - <http://www.census.gov/epcd/naics02/def/ND321219.HTM>

Agricultural Provisions (Cont.)

- In-field forklifts are exempt
- Retrofit owned uncontrolled 1990 and newer forklifts
 - 20 percent by January 1, 2009
 - Remainder by January 1, 2012
- ACPS operators are not responsible for:
 - Leased forklifts
 - Rental forklifts rented on or after January 1, 2009
 - Provided the leased and rental forklifts meet a 4.0 g/kW-hr (3.0 g/bhp-hr) standard or better

Equipment Dealer Provisions

- Customary business is the rental, leasing, or sale of LSI equipment
- Considered an operator of:
 - All service equipment regardless of hours of operation
 - Any operations equipment used more than 50 hours per year
- Service equipment is:
 - Used to support rental, leasing, or sales business, and is
 - Used more than 50 percent of time in this endeavor
- Operations equipment is:
 - Used as a rental or lease unit or designated for sale, and is
 - Used more than 50 percent of time in this endeavor, and

GSE Provisions

- Exclude 1990 or newer uncontrolled GSE from fleet average calculation if no verified retrofit available
 - If not available by January 1, 2007, exclude until January 1, 2011
 - If not available by January 1, 2009, exclude until January 1, 2013
- Compliance extensions for circumstances other than above
 - Initial up to two years
 - Follow-on one-year renewals
 - Demonstrate good-faith effort and document:
 - Insufficient emission-controlled GSE available
 - Use of emission-controlled GSE would result in significant safety or operational issues
- Exclusions/extensions end January 1, 2013
 - Then must add uncontrolled equipment into fleet average calculations

GSE Provisions (cont.)

- Counting of electric GSE in both LSI and Off-Road Diesel (ORD)
 - Prior to January 1, 2007:
 - Electric GSE could be counted in the LSI regulation, and
 - 20 percent of the electric GSE/diesel horsepower could be counted toward the ORD Rule
 - On or after January 1, 2007:
 - Electric GSE counted toward ORD Rule or the LSI Rule, but not both
- Counting of LSI GSE in both LSI and ORD Rules
 - LSI GSE may be counted toward the ORD Rule provided:
 - The LSI equipment operator can achieve their LSI FAEL standard with the equipment counted in the fleet (i.e., the operator cannot exclude dirty LSI by choosing to count it in ORD)
 - The LSI equipment operator can achieve their FAEL standard without the equipment in the fleet (i.e., the operator has an excess of clean equipment and doesn't need the LSI piece in question to achieve the FAEL standard)

Compliance Extensions

- Overriding philosophy:
 - Retrofitting may be the most cost-effective compliance option
 - Retrofitting is not the only compliance option
 - Staff will provide as much flexibility as possible
- Operators may request a two-year compliance extension if:
 - No verified retrofit emission control system available
 - Underwriter's Laboratories LPS (safety) designation
 - High-cost specialty equipment
 - OEM-controlled engine
 - Verified retrofit emission control system does not achieve FAEL
 - Larger displacement engines
 - Fully controlled fleets until 7 years / 13,300 hours
- Operators may request follow-on two-year extension if:
 - Still no verified retrofit emission control system available
- At the conclusion of the approved extension(s), operator must include subject equipment in FAEL calculation

Fact Sheets, Mail-Outs, EOs & FAQs

California Environmental Protection Agency | AIR RESOURCES BOARD

OVERVIEW OF THE

New Emission Standards, Test Procedures, and Fleet Requirements for Large Spark-Ignition (LSI) Engine Forklifts and Other Industrial Equipment

New rules to achieve significant emission reductions and protect public health

On May 25, 2006, the California Air Resources Board (ARB) amended the existing emission standards and test procedures for off-road large spark-ignition (LSI) engine powered equipment to make them more stringent. The ARB also adopted new regulations requiring emission reductions from existing LSI fleets and prescribing verification procedures for LSI retrofit emission control systems.

Why did the ARB staff propose these regulations?

There are more than 90,000 off-road LSI engines in California. Many of these engines have no emission controls and some remain in operator fleets for decades. Just one uncontrolled engine can emit as much hydrocarbon (HC) and oxides of nitrogen (NOx) in three eight-hour shifts as a new car certified to California's cleanest emission standard does over its entire lifetime. The HC and NOx combine in the atmosphere to form ground level ozone, which can damage the respiratory tract and worsen asthma symptoms. The LSI Regulation will reduce HC+NOx emissions by approximately six tons per day, helping California to meet federally imposed clean air standards. If these standards are not met, the federal government could impose economic sanctions on California; for example, federal highway funding could be withheld.

Who must comply with these regulations?

Manufacturers of 25 horsepower or greater (greater than 19 kilowatts) off-road LSI engines must comply with the new engine standards and test procedures and manufacturers of retrofit emission control systems intended for use on LSI engines must comply with the verification procedures.

Individual persons, businesses, and government agencies that own or operate LSI engine-powered fleets in California are subject to the fleet requirements. Out-of-state companies doing business in California are also subject to the fleet requirements.

What types of vehicles are subject to the regulation?

The new engine emission standards apply to manufacturers of any 25 horsepower or greater off-road LSI engine placed in, but not limited to, airport ground support equipment (GSE), forklifts, generator sets, sweeper/crubbbers, industrial tugs (tow tractors), and turf cars equipment. A full list of LSI equipment for which the engine standards apply is available at <http://www.arb.ca.gov/maprog/offroad/preempt.htm>

The fleet requirements only apply to forklifts, sweepers/crubbbers, industrial tow tractors, and GSE. Those four categories of equipment represent 94 percent of the total HC and NOx emissions from LSI equipment and are often found in fleets. Additionally, zero- and near zero-emission alternatives are available for the four equipment categories.

What does the regulation require?

Engine and Retrofit Emission Control System Manufacturers

The regulation establishes more stringent combined HC and NOx emission certification standards for engine manufacturers. The regulation also establishes verification procedures for manufacturers of retrofit emission control systems. Engine and retrofit emission control system manufacturers will likely employ advanced automotive-style emission control technologies including electronic fuel/air controllers, three-way catalysts, and oxygen sensors to meet the certification and verification standards, respectively.

- Fact Sheets
 - Available in English & Spanish
- Mail-Outs
 - Provide additional flexibility or guidance
- Executive Orders
 - Verified retrofit kits
- Frequently Asked Questions
 - Will be updated as necessary
- Available from website link at end of presentation

Recordkeeping Requirements

- The LSI regulation has **no** reporting requirement
- Operators must retain records
 - A baseline inventory due November 12, 2007
 - Contents: equipment/engine make, model, SN, certification or verification level as demonstrated by a label
- Operators no longer required to obtain fuel quality records
- Records retained through June 30, 2016
- Records may be aggregated at a centralized facility or headquarters

Enforcement

- EPA Authorization granted April 4, 2012
- First visits to start fall 2012; ramp up toward end of year
- Performed by ARB and possibly local air districts
- May be conducted in conjunction with other inspections:
 - In-use off-road diesel regulation
 - Cargo handling equipment regulation
 - Other mobile and stationary source regulations
- Penalty
 - Maximum of \$500 per day per piece of equipment

Contacts

- **Website:** <http://www.arb.ca.gov/lsi>
 - See “Program Links” for
 - Fact Sheets
 - Frequently Asked Questions
 - Guidance Documents and Advisories
 - Presentations (including this tutorial)
 - Regulatory Text
 - Verified Retrofit Emission Control System Executive Orders
- **Toll-free number:** [\(800\) 387-2992](tel:8003872992)
- **E-mail:**
 - **Mark Williams (Lead):** mwilliam@arb.ca.gov
 - **Elise Keddie, Manager:** ekeddie@arb.ca.gov